

(228)**Finite Element Representation of Focused Angle Beam Ultrasonic Wave Field in 3D Space**

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Modeling ultrasonic wave interactions within complex material structures often requires finite element methods. There is increasing interest and available resources for modeling three dimensional problems when the out of plane motion and influences are significant. Often the primary goal is to investigate wave interactions within a material structure or part definition, and wave excitation details are only of secondary importance. However, immersion ultrasound is often conducted with focused probes and at non-normal incident angles. This provides a challenge for modeling efforts due to non-planar wave fronts and complex mode conversion characteristics along the interface. Adding the full probe and water path to a model requires significantly more elements and computational resources. However, exploiting certain boundary condition options within PZFlex commercial software has been demonstrated toward achieving adequate efficiency gains for running practical models. Three approaches have been investigated for representing realistic 3D behavior: 1) Full 3D modeling of piezoelectric and lens components with “Free Field” (FFLD) boundary condition, 2) 3D extrapolation from a 2D axisymmetric probe model with FFLD boundary condition, and 3) elemental pressure wave definitions with phased array delay laws along a surface. Initial results, comparisons, and recommendations are discussed pertaining to these three approaches and their application toward practical ultrasound modeling efforts.

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